A Case Study on Management Process of Building Commissioning for a New Building in Hong Kong

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- Cx and its development in the world and Hong Kong
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Buildings

Building is a:

- safe and hygienic shelter
- business venue
- financially viable premises

QUALITY BUILDING is important

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Commissioning (Cx)

- Term derived from ship-building industry
- UK and USA models
- Hong Kong, Japan, Australia, China
- A Quality Assurance Strategy and Process leading to cost effectiveness and energy conservation building

Commissioning (Cx) - UK

- UK - “Advancement of an installation from the state of static completion to the full working order to specified requirements” - CIBSE
- Cx documents from CIBSE; BSRIA, CSA etc.

Cx - UK

- EU / UK Regulations on Energy / CO_2 concerns
- New Building Regulation Part L (1 & 2) regulates Cx process for dwellings and other premises, i.e. building heating, and BS systems (ACMV, Lighting) must be tested before occupation
- More management on design process

Cx - UK

- Management of Design with regard to Cx requirements (M)
- Acceptance – testing and commissioning (A, B, C, L, R, W)

Commissioning - USA

- "A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements" – ASHRAE Guideline 0
- ASHRAE, NEBB, AABC, BCxA

Cx - USA

- "T&C" as in UK is considered as Testing, Adjusting and Balancing (TAB) process, i.e .separate issue
- DOE - FEMP
- States Directives
- USGBC - LEED
- ASHRAE / ANSI Guideline 0, 1-1996
- ASHRAE 111-1988

Cx - HK

- Government – Architectural Services Department Cx Codes (originated from CIBSE Cx Codes in 1990, redrafted in 2002)
- Academic institutions' researches
- HKBEAM
- Trade Practice ???

Cx - HK

- Hong Kong Building Commissioning Centre (HKBCxC) initially formed in 2003
- Officiated in December 2004
- Non-profit making body aims to promote Cx practices for trade and benchmark competence of Cx people
- Publications on Cx code, training suitable for local building industry

Cx Popularity in HK

- Client's unawareness
- Designers can do all
- Contractor's capacity to test
- No Cx professionals
- Time and budget constraints
- Public concerns

Cx Popularity in HK

- Complicated process as massive documentations and validations on performance of equipment, sub-systems and systems
- Not easy, highly competent

A Case Study in HK

- A super 5 star hotel with rooms 300+ in CBD, built from mid 2003 to fall 2005
- Part of a leisure and commercial development complex built since 2000
- Central plant for hotel & apartments

Case Study in HK

- Traditional and typical local construction arrangement, with professionals of PM / Architect / Engineer / Surveyor
- No Cx Service Provider

Available Documents

- Only outline design and site progress documents could be made available for this study
- Review as per ASHRAE 1-1996, study focused on program, design, construction and commissioning stages, the final system performance was not being investigated but subject to interview

Findings in Program Phase

Without:

- Preliminary commissioning plan
- Commissioning cost estimation
- Commissioning guides, drawing and quality standards
- Management operators' specific requirements

Findings in Design Phase

Without:

- detailed Cx plan and specification, only general clause on Cx
- any inputs from Cx SP in general and particular technical specifications
- commissioning cost breakdown
- Cx schedule and program

Construction Phase

Only:

- General site coordination and progress meeting
- When delay anticipated in fall 2004 and a Cx Manager was assigned who are practically experienced in site works and received Cx training from USA (BCxA)

Immediate actions from CxM

- Reviewed the design documents and site progress
- Enquired Cx method statements with presentation from respective sub-contractors
- Drafted a consolidated work plan on Cx activities with priority
- Conducted site inspections and progress monitoring meeting

Actions in Acceptance Phase

- Arranged Cx activities sequence
- Commented on Cx submissions
- Arranged site staff to witness the test
- Conducted weekly Cx meeting
- Conducted training for O&M people
- Compiled the Cx report

Anticipated Results

- The work plan as “pseudo-cx documents” to original Cx plan and specification
- Smoothen various Cx activities with priority for partial occupation
- Presentation helped sub-contractors understand each other
- Main Contractor facilitated Cx

Anticipated Results

- Sub-contractors' Cx schedules made their own site progress committed
- O&M Manual was partially prepared before handover
- Some trainings on E&M system was conducted before take over

Anticipated Results

- Cx-Manager played a key role as
  - Site progress was improved
  - Cx activities had been streamlined
- Situation was improved and the case considered successful
- Cx process substantially completed and building occupied in Fall 2005

Interview with the Operator

- Interview conducted in early October 2006
- BCx was estimated about 60-70% completed before handover, remaining on going during occupation with seasonal adjustments, situation acceptable
- 6-8 months more to complete

Interview with the Operator

- Early involvement (in late construction) stage but lack of design information and document
- Energy consumption exceeds expected level though single equipment performance look normal e.g. boiler, HVAC
- No benchmark figures available

Interview with the Operator

- O&M manuals with T&C results are generally available before handover, this facilitates as benchmark, as well as benefit for future renovations and modifications during occupation
- Training period for staff appeared to tight, only on individual equipment instead of system
- Improve staffing and system familiarization

Highlighted Cx Problems (1)

Guest Room PAU

- No review on matching between desiccant wheel and cooling coil, lack of experience in testing desiccant wheel
- Higher primary air temp (25°C) caused condensation in guest rooms
- Stain appears on the air grill area

Highlighted Cx Problems (2)

Building Envelope (Curtain Wall)

- Leaking leads to air infiltration and water seepage
- Stain near the perimeter
- Remedial by sealing the outside perimeter, results not satisfactory
- Situation to be reviewed

Highlighted Cx Problems (3)

Ball Room Conditions

- Complaints on high temp ~23°C
- Zonal water balancing for PAU & AHUs inappropriate
- Lack of main / branch flow data
- 3 PAU & AHUs, partial load not reviewed in design

Highlighted Cx Problems (4)

Chillers

- Appeared no full load test in factory
- Difficult to regulate water flow to meet peak demand from hotel and apartment
- Waste energy to meet various demand especially when individual equipment need to full load running

Overall Comments

- Feedbacks to designer for design improvement
- Initial design data is necessary
- Cx data benefit the occupation and good reference to future changes due to renovations

Further Investigations

- Trend log analysis
- Continuous Cx monitoring
- System improvement study
- Energy audit

Thank You